

On the Dicotylinæ of the John Day Miocene of North America.

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The number of species of peccary-like pigs whose bones are found in the John Day Miocene beds of Oregon has not been fully determined. Prof. Marsh first determined their existence in this formation, and named a species *Dicotyles hesperius*. He was followed by Leidy, who added *Dicotyles pristinus*. Marsh afterwards described two species under the names of *Thinohyus lentus* and *T. socialis*. The present writer, at a still later date, added three species under the names of *Chænohyus decedens*, *Thinohyus trichænus*, and *Palæochærus subæquans*. My present object is to endeavor to determine the relations of these species to each other and to species and genera of pigs already known.

In the first place none of these species belong to the genus *Dicotyles*. Their premolars are quite distinct in composition from the true molars as in primitive mammalia generally. In *Dicotyles* the first in both jaws are identical with the true molars, or nearly so, and the preceding molars have internal tubercles, which the Miocene species do not possess. In *Dicotyles* there is also a preglenoid crest, which is wanting from the species in question. In all of these points the latter agree with *Hyotherium* von M. (*Palæochærus* Pomel), of the Miocene of Europe.

The full descriptions given by Gervais, and especially by Filhol, of this genus, enable the fullest comparisons with the American species to be made, at least as regards the cranial and dental characters. From these it results that the latter must be referred to one or more genera distinct from *Hyotherium*. The principal distinction is seen in the development of the canine teeth in the American forms, and the adaptation of the opposed part of the cranium to the inferior canine. The canines are sub-triangular in section, and the inferior tooth is received into a deep fossa of the premaxillary and maxillary bones, as in *Dicotyles*. In *Hyotherium* no such fossa exists, and the canine teeth are of relatively small size and of ordinary form. The Oregon species represent one or more genera intermediate in characters between *Hyotherium* and *Dicotyles*.

Two generic names have been proposed for these animals—*Thinohyus* Marsh, 1875, and *Chænohyus* Cope, 1879. The former is distinguished by Marsh from *Dicotyles* as follows:* “The most noteworthy differences seen in the remains under description are, an additional premolar in the lower jaw, and the extension of the posterior nares between the last upper molars. The orbit is not enclosed behind, and there is no antorbital fossa. The brain was small, less than one-half the size of that of a *Dicotyles* of the same bulk—and much convoluted. There is a strong bony tentorial ridge. The molar teeth have the principal cusps more isolated than in *Dicotyles* and the intermediate lobes larger.” It will be observed

* American Journal Sci. Arts, 1875, p. 248.

that this description does not refer to the characters of the premolar teeth which really distinguish these forms from *Dicotyles*. I also find the tubercles of the molar teeth in numerous examples rather less distinct from each other than is the case in the *Dicotyles torquatus*. Nor do I find the posterior nares to advance between the molars in any of my specimens which are not broken, but, on the contrary, this orifice is generally posterior in position to that which it occupies in *Dicotyles*. Disregarding these discrepancies, Mr. Wortman and I attempted to redefine this genus,* so as to represent the characters of the species known to us. I am now, however, inclined to think that we were premature in this endeavor, and that it is quite possible that we are yet unfamiliar with the true *Thinohyus*. As an attempt has been made to define the genus by Marsh, the name will have to be retained, but we must await fuller descriptions both of the genus and of its typical species, before we shall be able to give it its proper place in the system.

My specimens resolve themselves into two series, those which have three premolars in the upper jaw, and those which have four. I do not know of any specimen which has but three premolars in the lower jaw. The fourth premolar (first of the old nomenclature) of the superior series is a small tooth, and may be in some instances subject to irregularities. However, I retain the two genera, and compare them as follows:

Dicotylidæ with premolar teeth all different from true molars.
 Inferior canine received into a deep fossa of the upper jaw; canines sub-triangular in section; three superior premolars.....*Chænohyus*.
 Like the last, but four superior premolars.....*Bothrolabis*.
 Canines with oval section, not received into a fossa of the upper jaw;
Hyotherium.

It may be remarked of the John Day species, that there is no such excess of development of the first superior incisor in them as is seen in *Dicotyles*, and especially in *Hyotherium*. Three are constantly present in each premaxillary bone; but each mandibular ramus may have two or three.

In the following descriptions the notation of the premolars used by Kowalevsky and Schlosser has been adopted; viz: p. m. i is the next tooth to m. i.

Lithographic plates of these species have been printed, but cannot be published owing to the change of organization of the U. S. Geological Survey.

CHÆNOHYUS Cope.

Proceeds. Amer. Philos. Society, 1879, p. 373.

CHÆNOHYUS DECEDENS Cope, l. c.

This species was established on a large fragment of the cranium, which includes the orbits and all anterior to it, excepting the dentigerous portion

* Fourteenth Report of the State Geologist of Indiana, 1884, Part II, p. 17. Proceeds. Amer. Philos. Soc., 1887, p. 384.

of the premaxillary bone. It contains the posterior four molars, with the alveolæ of the anterior three premolars and the canine of the left side. The specimen belongs to the collection of Prof. Thomas Condon, of the University of Oregon, who kindly lent it to me.

The skull is remarkable for the abrupt contraction of its outlines anterior to the orbits, both laterally and vertically. The frontal region above and anterior to each orbit is swollen, indicating large sinuses. The anterior orbital border is notched twice, the superior emargination being rather shallow, while the inferior projects in an angle forwards, and the lachrymal foramen enters at its apex, just within the facial border. The muzzle is contracted, compressed, and short. The zygomatic arch springs abruptly, its external surface meeting the everted facial surface in an obtuse vertical angle. This angle is opposite the anterior edge of the second true molar. Its posterior base is opposite the second pair of cusps of the third true molar. The external face of the maxillary bone is directed inwards and backwards from this point, and forms a vertical angle opposite the internal margin of the last molar. Its internal border, commencing at this angle, extends forwards, but I cannot in the specimen distinguish it from the adjacent parts of the palatine bone, on account of its injured state. The palate is flat except next the molars, where its surface is recurved. The frontal region is flat, except at the superciliary borders, where it is slightly decurved.

The nasal bones are narrow, but they expand posteriorly so as to have a width three times as great as at the middle of the length. The posterior outline of both is a single convexity, whose middle point is at the line connecting the anterior border of the orbits. The length of contact of the nasal with the maxillary bones is 12 to 15mm. The lachrymal bone is higher than long, and wider above than below. Its anterior suture is nearly straight. The anterior part of the malar is deeper than the lachrymal, and its anterior suture is concave posteriorly.

The lachrymal foramen is single and round. The infraorbital foramen is vertical and is above the posterior border of the first premolar. The incisive foramina are large. The supraorbital foramina are close together, being separated by an interspace equal one-fourth that which separates each from the superciliary border. The grooves which extend from them anteriorly diverge gradually and are lost near the apices of the premaxillary bones. The palatine foramen is opposite the line of contact between the first and second true molars.

The dental series is remarkable for the rapid diminution of dimensions of the teeth from behind forwards. The last molar is fully equal in size to the corresponding tooth in the *Bothrolabis pristinus*, but the first true molar and first premolar are very much smaller than in that species. The same relation exists between this species and the *B. subæquans*. In comparison with the *B. trichænus*, the anterior teeth are smaller, while the last true molar is larger, in the *C. decedens*. The crowns of the molars are of simple constitution. They consist of four cusps, two external and two internal, the

latter a little behind opposite the former, and connected with them by an obscure intermediate tubercle. The latter is so far fused to the other two as to give a pair of transverse ridges somewhat depressed in the middle. The posterior intermediate on the last superior molar is a little in front of the larger ones which it connects, and a third intermediate is situated behind the space between the latter. This third intermediate is an upward production of a broad cordiform posterior cingulum of the crown. The external cusps on all the true molars in this species are remarkable for having their external faces flat, having thus distinct anterior and posterior edges. The internal face is convex to angular. There is a complete delicate external cingulum, and a wide anterior cingulum, but no internal cingulum. The first premolar has a nearly square outline instead of being transverse, as in the other species, and has one external and one internal cusp, connected by an elevated ridge. No rudiment of external second cusp. The internal cusp is much smaller than the external. A complete cingulum, except on the internal side; the external a delicate one. Second premolar with greater anteroposterior extent than the first. Its base contracts inwards through the obliquity of the external side. The crown is lost. The internal outline of the last four molars is straight, the external a little convex. The second premolar's form adds to the convexity. The alveolar border in front of the second premolar is broken, but there is no trace of alveoli or roots of another premolar until we approach the canine alveolus. Here a single root indicates a rather small fourth (or ? third) premolar. Its long diameter is directed inwards and forwards. The canine is large, but the root only remains in the alveolus. Its outline is that of an isosceles spherical triangle, with the apex directed posteriorly and outwards. Its alveolus occupies an enlargement of the maxillary bone, which is excavated on the anterior face to receive the apex of the inferior canine. This fossa has an acute posterior and superior border. In front its border is excavated by the alveolus of the large third superior incisor.

Measurements.

	M.
Interorbital width .....	.085
Depth to alveolar border at front of orbit.....	.080
Length from orbit (between notches) to canine fossa...	.091
Width of palate at p. m. i.....	.0255
“ “ “ m. iii (middle).....	.024
Length of molar series.....	.0815
“ “ true molars .....	.044
“ “ base of p.m. ii.....	.010
Diameters p.m. i { anteroposterior .....	.0085
{ transverse.....	.0095
Diameters m. i { anteroposterior .....	.0115
{ transverse.....	.0125

	Measurements.	M.
Diameters m. iii	{ anteroposterior.....	.018
	{ transverse.....	.016
Diameters base of canine	{ anteroposterior.....	.019
	{ transverse.....	.009

As compared with the collared peccary this species has a skull of about the same size, but rather more robust. The posterior molars are considerably more robust.

BOTHROLABIS Cope. Gen. nov.

The species of this genus known to me differ as follows. It may be remarked that they differ from those described by Marsh in their superior size. The latter are represented as being smaller, sometimes much smaller, than the common peccary. Those now described are equal to or larger than that species. The type of the genus is the *B. rostratus* Cope. It very probably includes the *Hyotherium americanum* S. & O.*

I. Muzzle short; a rudimental second external cusp of superior p.m. i.

Superior true molars longer than space from m. i to canine; last superior molar wide as long; fourth inferior premolar one-rooted; infraorbital foramen above middle of p. m. i.....*B. subæquans*.

II. Muzzle medium; one external cusp to superior p. m. i.

Superior true molars as long as space between p. m. i and canine; inferior p.m. iv two-rooted; infraorbital foramen above middle of p. m. ii; last superior molar longer than wide, with three cross-crests and no internal cusp at first valley.....*B. pristinus*.

As in *B. pristinus*, but fourth inferior premolar with one root, and superior m. iii with two rows of tubercles, and an internal tubercle at end of anterior valley.....*B. trichænus*.

III. Muzzle long, compressed; superior p. m. i with one external cusp. Molars small; true molars shorter than space from m. i to canine, last longer than wide, with two rows of tubercles; infraorbital foramen above middle of p. m. ii.....*B. rostratus*.

These species, with the *Chænohyus decedens*, form a series, which is measured by the increasing length of muzzle, and various other but consequent characters. One of these is the forward movement of the infraorbital foramen, and the anteroposterior development of the fourth inferior premolar. In addition to these, the series displays a coincident posterior extension of the base of the zygomatic arch. In the *C. decedens* it is anterior to the posterior border of the last superior molar. In the *Bothrolabis subæquans* it is opposite the same. In the *B. pristinus* it is posterior, and in *B. rostratus*, very much posterior to the last superior molar.

* Preliminary account of fossil Mammals from the White River formation; *Bullet. Mus. Compar. Zoöl.*, Cambridge, xiii, 5, p. 155, 1885.

BOTHROLABIS SUBÆQUANS Cope.

Palæochærus subæquans Cope. Proceeds. Amer. Philos. Soc. 1879, p. 374.

This species is only known to me from a single nearly entire skull with lower jaw in the collection of Prof. Thomas Condon, of the University of Oregon. The specimen he kindly lent to me, and my description and figures are based upon it. It is distinguished among those of its congeners by its abbreviated and robust form. This is seen in the steepness of its profile, the concavity of the side of the muzzle, and in certain details. Such are the position of the superior p. m. iv within the superior canine; the absence of diastemata between the premolars, and the shortness of the last true superior molar.

The frontal region is swollen above the anterior parts of the orbits, but is concave in front of the temporal ridges, except at the median line, which is obtusely keeled at this point. The profile does not descend abruptly as in the *Chænohyus decedens*, but forms a steeply descending straight line. In the same way the face is not abruptly contracted at the front of the malar bones, but slopes rapidly inwards, giving a wedge-shaped outline from above. Anterior to the compression the facial surface expands laterally and encloses the canine alveoli without abrupt enlargement. Anterior to these teeth the fossæ for the inferior canine are excavated upwards and backwards to a depth of about one-fourth the vertical diameter of the muzzle, the molar teeth being held horizontally. The greater part of the premaxillary bones are broken off. The orbit is not large. The postorbital process is large and decurved, with its compressed-acute apex pointing downwards, behind the line of the postorbital process of the molar. The anterior border of the orbit has two notches, the inferior the larger and including the lachrymal foramen. The supra-orbital border is nearly straight. The temporal ridges are sharply defined. The sagittal crest is compressed and deep through the posterior depression of the brain case, as it does not quite rise to the plane of the facial profile. The occiput is narrow and elevated, and its lateral crests are prominent, enclosing a spoon-shaped occipital fossa. The inion is a narrow truncate angle less than right. The occipital condyle projects at its superior part, exterior to the vertical line of the lateral occipital crest. The crest extends directly towards it without reaching it, and does not turn anteriorly to bound the temporal fossa below as in most Mammalia, including the peccary. It follows that the paroccipital and zygomatic crests originate independently. The latter is prominent, rising abruptly above and sloping backwards and inwards to a prominent apex nearer to the occipital condyle than to the postglenoid process. It has a deep transverse groove on its external face. The posttympanic region is a flat bone spread out against the posterior aspect of the zygoma as in pigs generally. Its flat posterior plane is nearly vertical. Below its inferior border projects the postglenoid process, which is narrow, thinning out and becoming more

prominent externally. At the superior border of the end of the post-tympanic plate the *meatus auditorius externus* issues. The posterior extremity of the angle of the zygoma rises above it, presenting a concave triangular face posteriorly, the apex upwards. The glenoid surface of the zygoma is horizontal in front, but its external half posteriorly rises externally. The otic bulla is larger than in any of the species here described, but its entire boundaries have not been exposed. Its transverse diameter is equal to the space between the apices of the paroccipital and posttympanic ridges. The zygomatic arch is rather short, its external face is flat, and its vertical depth is considerable. Its posterior angle is very prominent and compressed. The occipital condyles are small for the size of the skull.

The mandibular condyle projects very little vertically or posteriorly, but has considerable transverse extent. Its posterior face is in fact vertically truncate and the posterior border of the coronoid process rises directly from the anterior border of its superior aspect. The anterior edge of the coronoid conceals the posterior extremity of the third inferior molar. The inferior edge of the ramus is compressed and straight anteroposteriorly, and a little convex downwards. The symphysis rises obliquely but more steeply than the curvature of the ramus. Its median suture is preserved. The posterior base of the zygomatic arch is in transverse line with the posterior border of the third superior molar tooth. In *Chænohyus decedens* it is anterior to this line, and in *Bothrolabis pristinus* and *B. rostratus* it is much posterior to this line. The masseteric fossa is well marked but shallow in the vertical direction, not descending below the line of the inferior molars.

The nasal bones are narrow medially, but expand at a point opposite the anterior border of the lachrymal bone to four times that width. At the middle line posteriorly they present posteriorly an angle which is about right. The coronal suture crosses the angle formed by the converging temporal ridges, in a nearly straight short line. The apex of the premaxillary does not reach the frontal bone by 35 mm. The latter borders the maxillary by about 10 mm. The lachrymal is about as long as deep, and presents an angular process backwards into the orbit. The malar rises to opposite the lachrymal foramen, and its anterior border does not project beyond that of the lachrymal, and retreats a little posteriorly below. The posterior suture of the malar is not very oblique; it is concave and reaches the base of the postorbital process. The alisphenoid bone has little or no contact with the parietal. The latter descends more than half way to the base of the zygomatic process, and reaches theinion posteriorly. The posterior border of the squamosal is anterior to the lateral occipital crest.

The infraorbital foramen is above the middle of the first superior premolar. The supraorbital foramina are close together, being separated by an interspace which is one-seventh of the interorbital space. The lachrymal foramen is single, large, and within the orbital border. There are

three postparietal foramina, the inferior small and on the squamosal suture. The mastoid foramen is small, is anterior to the lateral occipital crest, and is apparently on a suture. There are two supraglenoid foramina, both small, the larger on the inner side of the base of the zygoma. The *meatus auditorius externus* is small, and is directed upwards and outwards. There is a foramen on the inner aspect of the line of contact of the posttympanic and postglenoid plates, which is probably continuous with the postglenoid. The stylomastoid foramen is, externally at least, longer than the postglenoid. The superior border of the foramen magnum is an open angle.

Of the superior incisor teeth only the third is preserved. The crown is oval and of moderate width. There were two inferior incisors in each ramus. Of the presence of a third I am very doubtful. They have rather narrow truncate crowns of equal width, and are directed upwards at an angle of 45° . The canines are robust. They have a subtriangular section, but the inferior triangle has a truncated (anterior) apex. These teeth differ from those of *B. pristinus* and *B. trichanus* in having two grooves separated by a ridge on the external sides, instead of one groove. The narrow anterior face of the inferior canine is also shallowly grooved.

The fourth superior premolar is almost entirely within the superior canine. It is small, but two-rooted. The third is much longer, and is much compressed. The second is but little longer than the third. Its crown consists of a single compressed cusp, with an internal cingulum which expands posteriorly, enclosing a narrow basin, and turning outwards forms a narrow basal heel. The first premolar has a base wider than long. Its external tubercle is bifid, the principal one supporting a rudiment of a second. The internal cusp is connected with the external by a transverse ridge, which does not reach the apex of the latter. A wide cingulum forms the internal and posterior outline of the crown. A narrow external, and no internal cingulum. The true molars are subquadrate in form, and increase in size posteriorly. The first is not so reduced in relative proportions as in the *Chænohyus decedens*. The external cusps are a little flattened externally, not so conspicuously as in the last-named species. Intermediate tubercles are present as in that species. An anterior and a posterior, a faint external and no internal cingula. The posterior cingulum is wide in the second molar and supports a rudimental third intermediate tubercle. In the third true molar it is wider and has a plicate border, but no considerable cusp. The second transverse series of tubercles of this tooth consists of those tubercles besides the intermediate tubercle in front of it, instead of two as exhibited by the other species. The external tubercle of this series is flattened on the external side. The intermediate tubercle of the first row is large and distinct. The crowns of the inferior molar teeth are not visible in this specimen. It can be seen, however, that the only diastemata in the series are very short, and are anterior and posterior to the fourth one-rooted premolar.

Measurements.

	M.
Length from I. iii to inion (axial).....	.205
“ “ “ “ postorbital apex.....	.135
“ “ “ “ anterior border of orbit.....	.098
Width of occiput (greatest) .....	.033
“ at zygoma at auditory meatus.....	.094
“ of brain case (greatest).....	.043
“ at postorbital processes.....	.088
“ “ zygoma at front of orbit.....	.082
“ “ facial constriction.....	.048
“ “ canine alveoli (external).....	.062
Least interorbital width.....	.070
Elevation of inion above foramen magnum.....	.0545
Vertical diameter of zygoma behind orbit.....	.022
“ “ “ “ at “ .....	.022
“ “ “ orbit.....	.030
“ “ “ cranium at front of orbit.....	.070
“ “ “ “ at third premolar.....	.050
“ “ of mandible at p. m. iv.....	.025
“ “ “ “ “ m. i.....	.039
“ “ “ “ “ m. iii.....	.039
Length of superior molar series.....	.088
“ “ superior true molars.....	.048
Diameters superior p. m. i { anteroposterior .....	.010
“ “ “ “ { transverse .....	.012
Diameters m. i { anteroposterior .....	.015
“ “ “ “ { transverse.....	.014
Diameters m. iii { anteroposterior .....	.0165
“ “ “ “ { transverse.....	.015
Diameters of superior canine { anteroposterior .....	.016
“ “ “ “ { transverse.....	.010
Diameters crown of inferior { anteroposterior.....	.012
“ canine { transverse .....	.0095
Width of crown of I. i inferior.....	.006
“ “ “ I. ii.....	.0055

The skull of this species has just the length and elevation of that of the collared peccary, but is more robust.

BOTHROLABIS PRISTINUS Leidy.

Dicotyles pristinus Leidy, Report U. S. Geol. Survey of the Territories, F. V. Hayden, 1873, I, p. 216; Pl. vii, figs. 13-14. *Palæochærus pristinus* Leidy, Cope, Bulletin U. S. Geol. Surv. Terrs., 1879, v, p. 58.

Of what I suppose to be this species I have a nearly complete skull without lower jaw, and a lower jaw from which the anterior teeth are

wanting, and a number of tooth-bearing fragments. I found a ramus with symphysis and part of the other ramus of an individual in Prof. Condon's collection, which I refer for the present to this species. The identification rests on the characters of the last two inferior molars, the only parts in the possession of Leidy when he described the species.

The skull is in its proportions intermediate between the extremes in the genus. The profile of the long muzzle is a nearly straight gradually descending line. Viewed from above the muzzle contracts gradually to the compression behind the canine alveoli, and then expands to contract abruptly in front of the latter, to terminate in the parabolic outline of the premaxillary region. The sagittal crest is mostly lost, but it is pretty certain that it descends from the profile line to the inion, which is below the frontal level. The ridge of the muzzle does not expand above the canines. The zygomata are flat. The interorbital region has an undulating surface, owing to the presence of swellings on each side of the middle line, and of a depression at the supraorbital foramina, and an obtuse median keel behind them. The postorbital processes are robust and decurved abruptly, the apices connected with the skull by a transverse plate with horizontal inferior edge. The superciliary border is carried a little anterior to the anterior border of the orbit. This border is only distinct above the lachrymal foramen; below that point the passage from the facial to the orbital surface is uninterrupted. The anterior origin of the zygomatic arch is equally gradual; posteriorly it arises from the posterior edge of the maxillary bone, which forms a line posterior to the third superior molar by 5 mm. Before reaching the longitudinal line of the malar, the border turns backwards and terminates in an apex which is directed backwards and inwards close to the pyramidal process of the palatine bone, from which it is separated by a fissure. The postorbital process of the malar bone is small, compressed and acute. It is anterior to the line of the postorbital process of the frontal. The superior edge of the zygoma is acute; the inferior beveled and truncate. The lachrymal bone extends downwards within the anterior part of the orbit and forms a prominent convexity whose long axis runs downwards and inwards, and it projects behind the posterior boundary of the maxillary bone. It encloses with the superior wall of the latter a deep fossa below and continuous with the orbit. The orbit is bounded posteriorly by a curved ridge which rises behind the foramen rotundum to near the base of the postfrontal process and turns forwards and disappears. A much more prominent angle commences behind the foramen rotundum and rising vertically soon disappears. The temporal ridges are pronounced, and are concave forwards. The lateral occipital crests are prominent and descend to near the condyles. The posterior temporal ridge is weak and continued subhorizontally from the zygoma behind, but it does not reach the lateral occipital crests. The paroccipital process has a robust base which stands at an angle of 45° , being less nearly vertical than in the *B. subaëquans*. It approaches nearer to the posttympanic plate than in that species, being

separated by a groove at its apex. The posttympanic is a flat fan-shaped bone appressed close to the postglenoid process. Its inferior edge forms a ridge running horizontally inwards and posteriorly, and enclosing a triangular space with the postglenoid, which is pierced by the postglenoid foramen. Between the foramen and the bulla of the ear is a small pisiform tuberosity. The otic bulla is small, and its long axis is longitudinal; its width is a little greater than the space between it and its fellow, and equals the space between the apex of the postglenoid process and the nearest point of the paroccipital. The basioccipital is weakly keeled at the middle line behind, but it is grooved at the anterior edge through the presence of a tuberosity on each side of the middle line. The groove soon disappears on the sphenoid. The inferior ala of the sphenoid forms with the pyramidal process of the palatine a long wall, which extends from the posterior contact with the maxillary bone to the internal base of the glenoid cavity. Its inferior margin is double, or grooved, the exterior edge being deeper posteriorly, the interior the deeper anteriorly. The posterior nareal border is divided by an osseous septum of 15 mm. in length on the inferior edge; the anterior border of the nares attains the line of the posterior edge of the last superior molars. The palate is flat, except a slight recurvature at the bases of the molars.

The sutural boundaries of the nasal bones are about the same as in the *B. subaquans*. Their anterior extremities are fortunately preserved. They are deeply notched, so as to be bifurcate, the internal angle being about as long as the external. The facial part of the lachrymal is subquadrate and its anterior suture forms a nearly straight line with that of the malar bone. The superior squamosal suture reaches half way to the sagittal crest, but not to the lateral occipital. The maxillopalatine extends anteriorly to a point opposite the middle of the first true molar. The premaxillary extends to within 50 mm. of the frontal, while the latter touches the maxillary by a suture of 10 mm. in length.

The *foramen magnum* is small. The lachrymal is single. The infra-orbitale issues above the middle of the p. m. ii. The supraorbitals are close together, being separated by a space equal to one-eighth the interorbital width. The *f. opticum* is rather large and is quite distinct from the *f. rotundum*, though near it. The latter and the *f. sphenoorbitale* appear to be united into a single large orifice. The *f. ovale* and *f. lacerum anterius* are not distinct. There is no *f. lacerum medius*, and the *f. lacerum posterius* is very narrow. The *f. stylohyoideum* is rather large; the *f. postglenoideum* looks downwards and inwards from between the posttympanic and postglenoid plates. The *f. condyloideum* is well isolated; it is oval and looks downwards. The *f. magnum* is a wide transverse oval. The *meatus auditorius externus* looks upwards into a triangular groove-like fossa of the triangular posterior face of the zygoma. There is one large postparietal foramen. No supraglenoid foramen. Mastoid foramen small, below the edge of the posttemporal crest. Palatine foramina opposite the middle of the first true molar.

The animal described is mature, and the crowns of the first and second true molars have lost their patterns by attrition. The fourth premolar is small, but is two-rooted, the anterior root nearly reaching the posterior edge of the canine alveolus. The third premolar is like it but larger, the second is still larger, and has the external cusp and internal cingulum spreading posteriorly as in the other species. The first premolar is wider than long and has but one external cusp; it has anterior and posterior, but no external nor internal cingula. The true molars have all the cingula but the internal. The third true molar has three transverse dentinal tracts besides the posterior cingulum, indicating three rows of cusps. The external cusp of the second row is distinct from the others and of conic form; it is bounded externally by the cingulum.

The canine has a single external median groove. Its section is triangular, but the anterior face is not so wide, and the posterior edge not so acute as in the *B. subaquans*. The fossa for the inferior canine enters the premaxillary to a depth equal one-fourth that of the muzzle at that point. In the *B. rostratus* it excavates to a depth of one-half the muzzle. Of the superior incisive alveoli, the first is a little larger than the third, and the third a little larger than the second.

Measurements of skull.

	M.
Length from premaxillary bone to probable inion.....	.250
“ “ “ “ postorbital apex.....	.175
“ “ “ “ preorbital border....	.155
“ “ “ “ infraorbital foramen.	.080
“ “ “ “ superior canine.....	.035
“ “ “ “ posterior nares.....	.148
Length of otic bulla.....	.0245
Width of otic bulla.....	.014
“ of occiput (greatest).....	.040
“ at zygoma at auditory meatus.....	.110
“ “ “ at front of orbit. ....	.100
“ of brain case (greatest).....	.059
“ at postorbital processes.....	.096
“ “ facial constriction.....	.034
“ “ canine alveoli (external).....	.056
“ “ “ “ on palate.....	.034
“ between p. m. i. ....	.024
“ “ m. iii.....	.022
“ of posterior nares .....	.0105
“ between otic bullæ.....	.0115
“ of foramen magnum.....	.016
“ between orbits (least).....	.081
Vertical diameter of zygoma behind orbit.....	.0225
“ “ “ “ at orbit.....	.0225

<i>Measurements of skull.</i>		M.
Vertical diameter of orbit.....		.034
“ “ “ cranium at front of orbit.....		.078
“ “ “ “ “ third premolar.....		.065
Length of superior molar series.....		.093
“ “ “ true molars .....		.049
Diameters superior p. m. i {	anteroposterior.....	.0095
	transverse.....	.013
Diameters superior m. i {	anteroposterior.....	.013
	transverse.....	.015
Diameters m. iii {	anteroposterior.....	.020
	transverse.....	.0165
Diameters superior canine {	anteroposterior.....	.015
	transverse.....	.009

The skull of this species exceeds that of the collared peccary, and is equal to that of the larger *Dicotyles labiatus*.

The lower jaw belonging to Prof. Thomas Condon, to which reference has been made, is referred with some doubt to this species. This is because it is accompanied by a superior posterior molar, which has not the characters of that of the *B. pristinus* in the lack of the third transverse series of tubercles. It is, however, not certain that this tooth belongs to the animal represented by the lower jaw.

In the latter there are two well-developed incisor teeth and an alveolus for a much smaller external one on each side. The fourth premolar is two-rooted and is separated by diastemata from the canine and from the third premolar of about the same length as itself. The other molars are in an uninterrupted series. The inferior molars have anterior and posterior cingula, but no external or internal ones. On the first and second there are no intermediates; on the third they are represented by median swellings in the bottoms of the transverse valleys. The heel is well developed supporting a median tubercle and lateral crenate edges. A narrow anterior cingulum. These inferior molars have the characters of the specimens described by Leidy as typical of the species.

<i>Measurements.</i>		M.
Width between inferior canines.....		.013
Diameters of m. ii {	anteroposterior.....	.0175
	transverse .....	.013
Diameters of m. iii {	anteroposterior.....	.021
	transverse.....	.0125
Depth of ramus at m. ii.....		.035

BOTHROLABIS TRICHÆNUS Cope.

Thinohyus trichænus Cope. Proceeds. Amer. Philos. Society, 1879, p. 373.

Established on a nearly complete dentition of both jaws in place, but

sufficiently open to display the crowns of the teeth. The rest of the skull is mostly wanting, though some parts of the base are probably preserved in the mass of matrix.

The first incisor is directed nearly vertically downwards. The external face of the crown is an oblique, wide vertical oval, convex on the internal and obliquely truncate on the external edge. The crown of the second incisor is smaller and more acuminate; there is no such difference in size between it and the first, as in *Hyotherium waterhousei* and other species of that genus, and both teeth are smaller than the corresponding ones in the *Dicotyles torquatus*. The superior canine is very robust. Its posterior edge is sharp, and the external face is flat, with a longitudinal shallow groove near the middle. The fourth premolar is wanting from both sides, but a space close behind the canine is probably its alveolus. A short interspace separates it from the third premolar. The latter has two roots and its base is nearly as long as that of the second premolar. The crown is lost. The second premolar is longer than wide, and is wider behind than before. It consists of an external cusp which has an angular apex of moderate elevation, and a basal internal cingulum. The latter arises posterior to the anterior base of the crown as a narrow ridge, and speedily expands posteriorly, enclosing a basin with the external cusp. It does not rise into a tubercle. The first premolar is as wide as long, and has a subquadrate base. It has but one, a simple external cusp, from the anterior part of which a transverse straight ridge extends inwards and ceases abruptly above the internal base. The posterior base of the tooth is therefore expanded, forming a table, while there is a rudimental anterior cingulum. No internal or external cingula.

The first and second true molars are of subequal dimensions, and are larger than the first premolar. The base of the first is subquadrate and slightly oblique. Its four cusps are connected by wear, so that I cannot determine the presence of intermediate tubercles excepting one near the centre of the crown. A cingulum, except on the inner side; the external faint. In the second true molar two intermediate tubercles are visible, but the anterior is fused with the external and internal anterior tubercles, so as to form a transverse crest, depressed in the middle. The posterior intermediate is in front of the posterior pair of tubercles, and there is no third or posterior cingular tubercle. Cingulum present except on inner side of crown, faint on external side. The third true molar is composed like the second, with the addition of a heel, and a tubercle on the inner side stopping the valley between the two cross-crests. The intermediate tubercles of this tooth are more conspicuous than in the m. ii. and the anterior is of equal elevation with the interior and exterior of the first row. This row is now quite oblique, looking posteriorly inwards. The heel has a median tubercle about the size of the second intermediate, which is flanked on each side by a plicated border or outline. The enamel of all these teeth is smooth.

There are three incisors in each ramus of the lower jaw. Their crowns

The first true molar is wanting. The second displays a crown a little longer than wide. It supports four cusps, without intermediates, whose bases are joined so that wear causes their dentinal centres to become continuous. A swelling in the valley represents the second intermediate cusp, while a similar swelling of the posterior cingulum represents the third. Cingula are represented by a posterior and anterior basal ledge. The third inferior true molar has two pairs of cusps and a large heel, the latter embracing a median basin. A low intermediate tubercle interrupts the middle of the anterior valley, and three low confluent tubercles fill the basin of the heel. The border of the latter is tubercular, the principal one being a little exterior to its median point. No cingula, but a short anterior ledge. Enamel smooth.

	M.
Length of superior molar series.....	.091
“ “ true molar series.....	.0463
Anteroposterior diameter of superior canine.....	.015
Diameters p. m. ii { anteroposterior0115
{ transverse009
Diameters p. m. i { anteroposterior0105
{ transverse011
Diameters m. i { anteroposterior0132
{ transverse0132
Transverse with crown of superior I. i010
“ “ “ “ inferior I. i0055
Anteroposterior diameter of inferior c.010
Length of inferior molar series099
“ “ “ true molar series.....	.050
Diameters m. ii { anteroposterior015
{ transverse012
Diameters m. iii { anteroposterior022
{ transverse012

Further investigations may show this species to be identical with the *B. pristinus* Leidy. The differences at present apparent are: first, the one-rooted p. m. iv, two-rooted in *B. pristinus*; second, the relatively rather smaller molars, especially the third superior. In the *B. pristinus* this tooth has a transverse series of tubercles on the heel which are rudimental in the *B. trichænus*, and the internal tubercle which stops the anterior valley is wanting in the *B. pristinus*. As compared with the *Chænohyus decedens* this species has a longer premolar region, and larger anterior molars and premolars.

BOTHROLABIS ROSTRATUS Cope. Spec. nov.

A cranium nearly entire, but without mandible, represents this species. The specimen indicates a species of larger size than the white-lipped peccary (*B. labiatus*), but of more slender proportions. An important character is found in the small size of the molar teeth. In this respect it compares with the *B. pristinus* much as the black bear compares with the grizzly.

In profile the interorbital region is concave, and the sagittal crest rises above it. The prefrontal region is gently convex, and the top of the muzzle is a gradually descending straight line. Viewed from above the outline is wedge-shaped to the contraction above the third premolar, and then expanded prominently for canine alveoli. The premaxillary region is not longer than in *B. pristinus*, while the facial part of the muzzle is considerably more elongate than in that species. Its profile has no such slope as is seen in *B. subæquans*, nor abrupt descent as in *Chænohyus decedens*. There is no median frontal rib as in *B. pristinus*. The alveolus of the superior canine is produced downwards below the remaining alveolar border, so that the fossa for the inferior canine is excavated into half the depth of the muzzle instead of only one-fourth as in the species already described. This may be a character of the males only. The zygomatic arch is peculiar in that the postorbital portion is considerably shallower than the orbital portion. Its postorbital process is large. The postorbital processes of the frontal are both broken at the apices, but so far as preserved they resemble those of the other species. A little process extends into the orbit from its anterior border, below which the latter is not very well defined. The orbit is not very large, and its long axis is oblique anteroposteriorly and in the vertical plane. The posterior apex of the zygomatic process of the squamosal is broken, but it was evidently not so robust as in the species already described. The postglenoid is transverse and compressed to an acute free edge, and the posttympanic plate is closely appressed to it. The paroccipital process is elongate, and the apex contracts from the base. The latter lies at an angle of 45° inwards and forwards, rising from the edge of the otic bulla. The occipital condyles are small, and are laterally expanded. The otic bullæ are placed longitudinally and are small regular ovals. Their transverse diameter is less than the width of the space between them, and equals the space between the external bases of the postglenoid and paroccipital processes. The basi-

occipital is flat posteriorly, but anteriorly it has an open shallow median groove, with a low ridge on each side.

The occiput is damaged, but the lateral occipital crests descend to near the condyles without sending a branch to the zygoma. The posterior temporal ridge commences above the external portion of the occipital condyle. A single prominent angular ridge dividing the temporal from the orbital fossæ continues from the postfrontal process to internal angle of the preglenoid boundary. The inferior sphenoid ala is continuous from this point to and with the pyramidal process of the palatine, forming a vertical plate flared outward at its superior border. The border of the posterior nares is about as far posterior to the last superior molar as the length of that tooth, and opposite to the posterior extremity of the maxillary bone. This is further posterior than in any of the other species. The zygomatic foramen is encroached on by the convexity of the inferior part of the lachrymal bone which is in this species subhorizontal, and not oblique as in the *B. pristinus*. It is therefore continuous with the zygomatic expansion of the maxillary bone, and serves to place the posterior origin of the zygomatic arch much further back than in any of the other species here described. The outlines of the zygomatic arches are flat, and slightly wider behind than before. The palate is flat, except posterior to opposite the last superior molars. It then slopes upwards at an open angle. The premaxillary palatal face is a little decurved.

As the animal described is old, the sutures are obliterated.

The infraorbital foramen is above the middle of the second superior premolar, and is a vertical oval. The supraorbital foramina are small and close together, the space between them being one-seventh the interorbital width. There are two postparietal foramina placed rather low down, the inferior on the squamosal suture. A very small supraglenoid foramen on the inner side of the zygomatic process. The *foramen magnum* is wider than deep if we except a deep notch of the superior border. The *f. condyloideum* is entirely distinct, and is a longitudinal oval. The *f. ovale* is not distinct from the *f. lacerum anterius*. The *f. postglenoïdeum* is at the inner side of the postglenoid process. The meatus auditorius externus is lost with the zygomatic angle, but its canal is remarkably small. The *f. palatinum* is opposite the first true molar. The *ff. incisiva* are distinct from each other, and rather large, the two, with their septum, forming a circle.

The incisive alveoli of the premaxillary are of moderate size, and the first and third are equal, and the second a little smaller. The canine alveoli are large and pedunculate; the crowns are lost. The fourth premolar is separated from the latter by a diastema; it has a simple compressed crown, and is two-rooted. The third premolar is similar but larger, and is preceded and followed by diastemata, the former as long as itself, the latter a little shorter. The second premolar is like that of the other species of the genus. The first is wider than long, and has one external and one internal cusp, and posterior and anterior cingula, the former the wider. The crowns of the first two true molars have lost their

pattern through wear. That of the third is but little larger than that of the second. Its posterior border is obliquely convex, being most prominent at the internal side. It has two cross-rows of cusps and a heel, the latter with an internal cusplet. The intermediate tubercles are distinct, and there is one in the valley between the two rows. This tooth has only a trace of an external cingulum, and no internal one.

<i>Measurements.</i>				M.
Length from premaxillary bone to foramen magnum				
			inclusive.....	.270
"	"	"	" postorbital process..	.228
"	"	"	" preorbital border ..	.185
"	"	"	" infraorbital foramen	.105
"	"	"	" superior canine....	.040
"	"	"	" posterior nares.....	.173
"	of otic bulla.....			.0215
Width	"	"	.....	.016
"	at zygoma at auditory meatus .....			.098
"	"	"	" front of orbit.....	.118
"	of brain case (greatest) .....			.026
"	at postorbital processes .....			.083
"	between orbits (least) .....			.078
"	at facial constriction.....			.041
"	"	"	" canine alveoli (external) .....	.059
"	"	"	" on palate .....	.036
"	between p. m. i .....			.029
"	"	"	m. iii.....	.033
"	of posterior nares .....			.011
"	between otic bullæ .....			.016
"	of foramen magnum .....			.018
Vertical diameter of cranium at last molar.....				.079
"	"	"	" " third premolar.....	.043
"	"	"	" orbit.....	.035
"	"	"	" zygoma at orbit .....	.024
"	"	"	" behind orbit .....	.016
Length of superior dental series .....				.152
"	"	"	" molar " .....	.089
"	"	"	" true molars.....	.044
Diameters of p. m. i { anteroposterior .....				.010
{ transverse .....				.013
Diameters of m. i { anteroposterior .....				.013
{ transverse .....				.014
Diameters of m. iii { anteroposterior .....				.018
{ transverse .....				.0125
Diameters canine alveolus { anteroposterior.....				.016
{ transverse .....				.0135

From the John Day bed of Oregon, on Camp Creek. Discovered by Dr. J. L. Wortman.